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ABSTRACT

Scientific research that is conducted without the structure of a supporting scientific paradigm should be labeled pseudoscience in that such research is deceptive or false science. It is argued that much of the research in educational technology is pseudoscience, with the focus on learner control research. Learner control is the design feature of computer-based instruction that enables learners to choose freely the path, rate, content, and nature of feedback in instruction. It is contrasted with program control. Much of the research into learner control constitutes pseudoscience in that it fails to meet the major theoretical and methodological assumptions underlying accepted research methodologies within the positivist, quantitative paradigm. In the first place, the concept of learner control is poorly defined. In many studies the instructional treatments used are too brief to provide learners with sufficient experience for learner control variables to be actualized. In many media replication studies there is a lack of consequential or relevant outcome measures. Small sample sizes and large attrition rates are other problems that plague learner control research. Suggestions for improving the quality of learner control research, including the exploration of alternative research paradigms, are presented. One figure illustrates the continuum of learner control. (Contains 41 references.) (SLD)

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ED 362 196

Title:

Pseudoscience in Instructional Technology: The Case of Learner Control Research

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Pseudoscience in Instructional Technology: The Case of Learner Control Research

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Introduction

According to the latest version of the *Encyclopedia of Educational Research* (Alkin, 1992), there are currently "three major paradigms, or three different ways of investigating important aspects of education" (p. 620) in use by educational researchers (Soltis, 1992). These paradigms are described as:

- the positivist or quantitative paradigm,
- the interpretivist or qualitative paradigm, and
- the critical theory or neomarxist paradigm.

Soltis (1992) concludes that these paradigms currently coexist within the educational research community "in a state of tolerance and struggle" (p. 621). Some view the three paradigms as necessary to yield a full and complete picture of educational phenomena (cf., Salomon, 1991) whereas others regard them as incompatible (cf., Cziko, 1989, 1992), or as Kuhn (1970) would put it, incommensurable.

There is another perspective, espoused by Yeaman (1990) among others, that educational research (along with the other behavioral sciences) is what Kuhn called pre-paradigmatic. According to this perspective, educational research lacks the components of a Kuhnian research paradigm such as strong theory, valid measurements, unambiguous research designs, and reliable analytical processes.

Scientific research that is conducted without the structure of a supporting scientific paradigm should be labeled "pseudoscience" in that such research is false, deceptive, or sham science. The title of this paper is meant to put forth the thesis that some, perhaps most, research in the field of instructional technology is pseudoscience. It is beyond the scope of this paper to provide a comprehensive critique of the complete spectrum of research in the field of instructional technology. Instead, this paper presents a critique of that type of instructional technology research that is based upon what Soltis (1992) called the positivist or quantitative paradigm. More specifically, this paper focuses on a critique of a body of quantitative inquiry known in the field as "learner control research" (Steinberg, 1977, 1989).

Caveats

Before presenting a critique of learner control research, a few caveats are necessary. First, calling instructional technology research "pseudoscience" may seem overly harsh because it suggests that the people engaged in this research are corrupt. The following critique should in no way be interpreted as suggesting that the authors of the studies reviewed have engaged in any wrong-doing.[1] Instead I believe that they have followed powerful, albeit misguided, dictates to be scientific in the same way that older, more established sciences, are scientific. The desire to be scientific is endemic in our field and many closely related educational and psychological fields. This desire has many motivations, not the least of which is survival in a "publish or perish" academic culture (Yeaman, 1990).

Second, this critique is not about the debate between the merits of basic versus developmental research. A more serious problem in our field is that so much of the research that is supposed to be basic subscribes to the concepts, procedures, and analytical schemes of positivist, quantitative inquiry without meeting the theoretical and statistical requirements of that paradigm (Orey, Garrison, & Burton, 1989). In short, the problem is really one between valid and invalid research, or as described in this paper, science and pseudoscience.

Third, this critique, while not wholly original, should not be viewed as redundant, as was suggested by one of the reviewers of this paper. Although many critiques have been made of positivist inquiry in education in general (cf., Cziko, 1989, 1992; Phillips, 1987) and instructional technology in particular (cf., Clark, 1989; Reeves, 1986, 1989), studies of this type continue to be pervasive. Indeed, hardly an issue of the research journals in our field (cf., *Educational Technology Research and Development*, *Journal of Computer-Based Instruction*, *Journal of Research on Computing in Education*) appears without one or more reports of these types of studies.[2]

Learner Control

Learner control is defined as the design features of computer-based instruction[3] (CBI) that enable learners to choose freely the path, rate, content, and nature of

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[1] Of course, only the most naive person would maintain that there is no corruption involved in instructional technology research just as there is in other types of scientific and pseudoscientific inquiry. It is not unusual to find out that scientists in the "hard" sciences as well as medicine, representing highly respected research institutions, have faked data or intentionally misinterpreted findings (Sykes, 1988). This no doubt occurs in our own field as well.

[2] This is hardly surprising given that how people conduct research "is based largely on the skills and ideas that are tacitly transmitted during what could be called a scientist's apprenticeship, in graduate school for example" (Bohm & Peat, 1987, p. 52). Many members of the tenured generation of instructional technology faculty who dominate the teaching of research methods in instructional technology graduate programs were schooled in positivist methods and may be unfamiliar with or uncomfortable with alternative approaches.

[3] Computer-based instruction is used rather loosely in this paper to include a wide range of interactive learning systems, ranging from a simple tutorial to a complex learning environment.

feedback in instruction. Learner control is contrasted with "program control," i.e., design features that determine the path, rate, content, and feedback in instruction for learners. Learner control and program control represent a continuum of learner latitude that varies widely both within and between different instances of CBI.

Proponents of CBI claim that CBI allows students to be in control of their own learning, and further, that being in control of learning results in greater achievement. Although this popular belief is often debated, the research evidence for and against these claims is extremely weak because, as documented below, inappropriate research methods have been used to investigate issues of learner control. A major thesis of this paper is that most of the learner control research currently reported constitutes "pseudoscience" in that it fails to meet the major theoretical and methodological assumptions underlying accepted research methodologies within the positivist, quantitative paradigm (Orey et al., 1989).

Given the inadequacy of the research conducted to date, it should not be surprising that research support for learner control is inconsistent. Steinberg (1977, 1989) sums it up as follows:

> Learner control sometimes resulted in greater task engagement and better attitudes, but not necessarily in greater achievement. In some instances learner control led to worse performance than computer control. While many students were motivated by learner control, others were indifferent to it. Aptitude and trait-treatment research yielded no definitive conclusions about learner control (Steinberg, 1989, p. 117).

Ross and Morrison (1989) conclude, "research findings regarding the effects of learner control as an adaptive strategy have been inconsistent, but more frequently negative than positive." Ross and Morrison claimed that at least part of the problem may be insufficient precision in defining just what is meant by "learner control" in various studies, and that learner control probably is not "a unitary construct, but rather a collection of strategies that function in different ways depending on what is being controlled by whom."

Problems with Definitions of Learner Control

Learner control is a concept that seems to mean something very clear and important, but it is so loosely defined in practice as to mean very little. Of course, in the scientific sense, learner control is a construct. A construct is a concept that has been intentionally synthesized on the basis of observation and/or theory to represent an idea or a phenomenon. As a scientific construct, we must be concerned with how learner control is defined and measured.

Learner control has been one of the most heavily researched dimensions of CBI in recent years (Steinberg, 1989). Figure 1 illustrates the learner control dimension in CBI ranging from complete program control to unrestricted learner control.

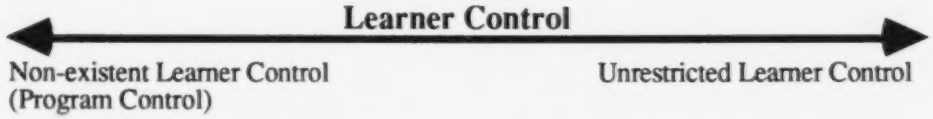

Figure 1. Learner control dimension of CBI.

Upon first consideration, learner control may seem like a simple concept in that it refers to the options in CBI that allow learners to make decisions about what sections to study and/or what paths to follow through interactive material. However, more careful consideration indicates that learner control is a very complex issue. For example, whenever learner control is defined, we must ask ourselves what is the learner controlling. In some cases, it may simply be the rate or order of screen presentations. In other cases, it may involve the activation of multiple microworlds and support systems within a complex learning environment in which the learner virtually authors his/her own CBI.

The "control of what" question is a critical one if we ever wish to have any meaningful impact on the design of CBI (Ross & Morrison, 1989). The finding that learner control of context for examples is effective in one setting and another finding that learner control of amount of review is effective in another setting provides little basis for linking these two types of learner control into a meaningful prescription for design of CBI. Even less guidance is provided for linking the dimension of learner control with other critical dimensions of CBI, e.g., structure.

Hannafin (1984) needed eight qualifying statements to support the application of learner control, and the recent research of Ross and Morrison (1989) and others indicates that even more specific qualifiers may be needed to clarify the effectiveness of learner control in different cor.texts. Can such complex statements be logically integrated with equally complex explications of other relevant variables to provide a clear basis for interactive design decisions? When do such complexities begin to exceed the human conceptual capacity to deal with seven plus or minus two variables at one time? Or are we in the situation that Cronbach (1975) so eloquently described of not being able to pile up generalizations fast enough to keep up with the process of learning?

It seems that researchers in instructional technology have come to use terminology such as learner control without sufficiently examining the meaning and implications of the construct. It is almost as if the mere utterance of a term like learner control brings it into meaningful existence. However the philosopher Alfred Korzybski (cited in Bohm and Peat, 1987) describes the danger of this way of thinking. Korzybski noted that our observations of the world around us are limited both by the frailties of our perceptual senses and our existing knowledge that shapes our interpretation of sense data. Further, he maintained that every kind of thought conceived as a result of observations is an abstraction that reveals only a limited view or slice of reality as we perceive it. Words or concepts in turn are abstractions of thought, and as such, fail to capture the complete essence of a thought. Consciously constructed concepts such as "learner control" are even further removed from our sense data, thoughts, and concepts. Our measures of scientific constructs represent yet another layer of abstraction, and the mathematics and statistics with which we analyze the data collected with our measures introduce additional abstraction. Finally, even more abstraction is required to go back down through the chain of abstractions to relate statistics to conclusions about the nature of reality.

All this, of course, is the very "stuff" of science. Well-established sciences such as physics deal with these very same problems. The solution of these problems in physics required the development of a series of scientific paradigms, one replacing the other with a more or less cohesive infrastructure of tacit beliefs and methods. The construction of paradigms in physics did not occur overnight, and some

maintain that they are far from settled (cf., Regis, 1987). For example, the concept of atoms was around for thousands of years before it was considered seriously. Today, the commonplace understanding of atoms as tightly compacted concoctions of electrons and neutrons has yielded to a concept of atoms containing vast volumes of empty space sparsely populated by subatomic particles of many kinds (Pagels, 1988).

As noted above, this is not the first paper to suggest that instructional technology research and educational research in general suffer from a lack of well-established paradigms (cf., Yeaman, 1990). However, being "pre-paradigmatic" is not necessarily an undesirable state. There are at least two perspectives on this. Kuhn (1970) maintained that even the most established sciences such as physics have had a pre-paradigm stage, and that most contemporary social sciences are still at that stage. Kuhn wondered why social science researchers worry so much about whether they are really scientists:

> Inevitably one suspects that the issue is more fundamental. Probably questions like the following are really being asked: Why does my field fail to move ahead in the way that, say, physics does? What changes in technique or method or ideology would enable it to do so? These are not, however, questions that could respond to an agreement on definition. Furthermore, if precedent from the natural sciences serves, they will cease to be a source of concern not when a definition is found, but when the groups that now doubt their own status achieve consensus about their past and present accomplishments. (pp. 160-161)

Kuhn's emphasis on reaching consensus within a paradigm is intriguing. As instructional technologists, we are far from agreement regarding our past and present achievements. Reflecting the larger debate occurring among educational researchers of every kind, some instructional technologists view the past several decades of "media research" as having extremely limited value (cf., Clark, 1989). Others prefer to salute generations of previous research in instructional technology as laying the foundations for present day inquiry (cf., Ross & Morrison, 1989). However, if we must come to agreement concerning these issues before we can become "scientific," I would hope that we remain in the controversial pre-paradigmatic stage for some time to come.

Another perspective on the pre-paradigmatic stage is provided by two physicists, David Bohm and F. David Peat (1987). They maintain that over-emphasis on paradigmatic purity is to blame for much of the fragmentation in physics and other "hard" sciences. They maintain that a paradigm can be, and often is, detrimental to the creativity that underlies authentic inquiry. They claim that Kuhn is often misinterpreted as supportive of paradigm changes. Bohm and Peat argue that Kuhn actually viewed paradigms not as fundamental theories, but as "a whole way of working, thinking, communicating, and perceiving with the mind" (p. 52). Bohm and Peat regard the tacit or unconscious consent that pervades a given paradigm as exacting too heavy a price on the mind and the senses, shutting down the imagination and playfulness that the mind requires for meaningful inquiry. If achieving the status of a scientific paradigm means that we must sacrifice some of our creativity, I would prefer to remain pre-paradigmatic for a long time to come. We need creativity above all else. As Robert Ebel, a past president of the American Educational Research Association (cited in Farley, 1982) pointed out, ".....it (education) is not in need of research to find out how it works. It is in need of creative invention to make it work better" (p. 11).

Returning to the difficulty of defining learner control, at least part of the problem stems from the lack of an infrastructure of tacit understandings and methods to support this construct. In other words, we lack a scientific paradigm to guide research regarding learner control. However, as described below, this has done little to dampen the ardor of researchers in our field.

Problems with Learner Control Research

As indicated in the reviews by Ross and Morrison (1989) and Steinberg (1989), increasingly large numbers of research studies have been carried out to investigate the relative effectiveness of learner control. These investigations are focused on isolating the attribute or dimension of CBI called learner control and estimating its effectiveness in a variety of implementations (e.g., learner control with advisement versus learner control without advisement.) However, learner control studies have often led to no significant results in terms of the predicted main effects (cf., Kinzie & Sullivan, 1989; López & Harper, 1989; McGrath, 1992; Ross, Morrison, & O'Dell, 1989; Santiago, 1990). In fact, technical and methodological flaws largely invalidate these studies.[4]

First, it is clear that the instructional treatments used in these studies are usually far too brief to provide learners with sufficient experience for learner control variables to be "actualized." Kinzie and Sullivan (1989) reported that mean completion times for the experimental and control CAI lessons were 29 minutes, four seconds for the former and 29 minutes, six seconds for the latter, and López and Harper (1989) estimated that their CBI lesson treatment was "approximately 30 minutes in length." The treatments experienced by the students in the Ross, Morrison, and O'Dell study (1989) averaged between 25 and 30 minutes, and the students in the Santiago (1990) study averaged 30 minutes in the actual CBI lesson after a 15-20 minute orientation to the computer presented by the researcher. McGrath's (1992) students averaged only 13 to 17 minutes in their hypertext, computer-assisted instruction, no-choice CAI, or paper treatments.

Cronbach and Snow (1977) cautioned that ten or more separate interactive sessions were necessary to acquaint students with innovative instructional treatments. How can a dimension as complex as learner control be expected to have an effect in one session treatments lasting less than an hour? Suppose that a medical researcher was investigating the effects of an aspirin regimen on subsequent heart disease. The medical researcher might be interested in varying regimens of aspirin (one a day versus one every other day), but he/she would not look for the effects of administering a single aspirin on one occasion. And yet, we seem to be willing to place students in an analogous situation vis á vis learner control and expect meaningful results.

Second, there is a lack of consequential or relevant outcome measures in many media replication studies. Kinzie and Sullivan employed CAI lessons on solar energy and tarantulas, subjects not clearly articulated with their regular science curriculum. Although the seventh and eighth grade students in the López and Harper (1989) study were told that their grades would be reported to their teacher, the thirty minute lesson on insects was unrelated to their normal curriculum. The

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[4] The five studies selected for this critique are representative of a larger collection of similarly flawed studies. A comprehensive analysis of available learner control studies is underway.

undergraduate teacher education student "volunteers" in the Ross, Morrison, and O'Dell (1989) and the Santiago (1990) studies received "credit" toward course grades for participating in the research, but the content subjects were only indirectly related to the courses in which the students were enrolled. McGrath's (1992) subjects were also undergraduate teacher preparation students enrolled in a media course, but the subject of the treatment lesson involved the mathematics of determining surface areas of hollow figures.

Subjects in learner control research should be engaged in learning that is personally meaningful and that has real consequences for them. Further, volunteer subjects learning content unrelated to their education or training needs or interests are inappropriate because this practice introduces unacceptable threats to internal and external validity (Isaac & Michael, 1971). It is ironic that so many learner control studies utilize researcher-created interactive materials when a number of large scale interactive learning systems are available. Examples include *Macintosh Fundamentals*, an interactive videodisc training course developed by Apple Computer, Inc. (1990) and *Illuminated Books and Manuscripts*, a set of five interrelated educational multimedia programs produced by the IBM Corporation (1991). Finding situations in which these and similar large scale programs are used in realistic contexts may be challenging for researchers, but the alternative compromises exact too great a price.

Two other concerns are small sample sizes and large attrition rates that leave some cells in the analyses with inadequate numbers of subjects. Another problem concerns dropping subjects from the analyses who have correctly answered all questions within the interactive lessons, as was done in the Kinzie and Sullivan (1989) research. Without missing a correct response, these students clearly had no opportunity to experience learner control or program control over review. And what about students who only missed one or two of the fifteen questions interspersed into the CAI lessons? Did they "experience" the treatment variables?

Clark (1989) is correct in suggesting that many of these and similar studies in instructional technology are conceptualized without an adequate understanding of all the related theoretical assumptions and pertinent research findings. As a result, little guidance is provided for linking the dimension of learner control with other critical dimensions of CBI, e.g., screen design or feedback. The conclusions presented in some of the studies cited above are nothing less than convoluted. The irony is that in reading any single one of these complex "explanations" of why significant findings were not found, the reader may find the researcher's arguments somewhat plausible. The real complexity arises when one tries to make sense of these explanations across the various research reports. In the end, we must ask ourselves how such complex statements can be logically integrated with equally complex explications of other relevant variables to provide a clear basis for CBI design decisions (Reeves, 1992).

What should be done?

This paper presents evidence that learner control research studies are flawed in terms of sample sizes, treatment duration, content selection, and other theoretical and methodological issues to such an extent that the research has little value. (The criticisms of learner control research described above could easily be extended to other areas of research in instructional technology, e.g., studies on screen design issues.) These flaws and fundamental problems arising from a lack of a scientific paradigm to guide research in this field yield a conclusion that the

positivist research we are currently conducting is largely pseudoscience.[5]

However, it is not enough to critique research in our field. I wish to suggest some new directions. First, there is a serious need for graduate students and researchers in our field to develop an improved understanding of contemporary philosophy of science. Courses in the philosophy of science, preferably taken outside Colleges of Education, would expose researchers to a larger spectrum of approaches to inquiry than found in many traditional courses emphasizing experimental and quasi-experimental designs. Phillips (1987) speaks to this need, "New approaches to the design of evaluations of educational and social programs are being formulated that make the "true experiment" seem like a lumbering dinosaur, yet some folk persist in thinking that dinosaurs are wonderful creatures" (p. viii).

Second, I believe instead of worrying about whether or not we have a paradigm in which to conduct research in instructional technology, we should begin to address some of the questions that Kuhn (1970) suggests underlie our concerns. Important questions include: Why hasn't our field moved ahead as others have? What techniques, methods, or ideologies will enable us to progress? In other papers (Reeves, 1986, 1990, 1992), I have suggested that we explore alternative approaches to research in our field such as computer modeling (Pagels, 1988) and formative experiments (Newman, 1990). These alternative approaches address systemic rather than analytic issues in educational contexts. (Salomon (1991) provides an excellent overview of the differences between systemic and analytic approaches.) The value of systemic approaches are that they provide the basis for theory and hypotheses that may be investigated using analytic procedures. Salomon (1991) summed the issue up this way, "Without observations of the whole system of interrelated events, hypotheses to be tested could easily pertain to the educationally least significant and pertinent aspects, a not too infrequent occurrence" (p. 17). Such is the case in learner control research.

Third, the time to explore alternative research paradigms in our field has never been more critical. Instructional technology as a field may be in danger of becoming irrelevant. One of the field's major components, instructional design (Briggs, Gustafson, & Tillman, 1991), is under attack in several quarters (cf., Carroll, 1990; Gery, 1991). Further, some of the most advanced learning environments are being created by cognitive psychologists and others in fields outside instructional technology, such as the *Jasper Series* at Vanderbilt University (Cognition and Technology Group at Vanderbilt. 1992).

Exploring alternative research paradigms might also encourage us to undertake more of the "creative invention" that Ebel claimed is needed in education (cited in Farley, 1982). This may require changing the reward structures in traditional academic settings. It is pathetic that the creation of an interactive learning system with the potential to change the lives of hundreds, even thousands of people, is given less worth in some academic settings that a "research" paper published in the most

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[5] Some, perhaps many, will disagree with this conclusion. One rebuttal of the thesis that learner control research is pseudoscience might involve making a case that the example studies cited are simply poor studies, and that studies that eliminate the flaws in these studies by incorporating substantive treatments over a meaningful period of time with large samples in practical contexts would be "real" science. However, such a defense does not address the problems of defining learner control as described above.

arcane journal.[6]

As noted earlier in this paper, Soltis (1992), writing in the *Encyclopedia of Educational Research* (Alkin, 1992), describes three major paradigms for inquiry in education, the positivist (quantitative), the interpretivist (qualitative), and the critical theorist (neomarxist). I don't know enough about the neomarxist paradigm to comment on its applicability in our field. However, I do believe that we could benefit greatly from well-conceived qualitative inquiry in our field. I recommend that we call a moratorium on the types of quantitative studies described in this paper, replacing them with extensive, in-depth efforts to observe human behavior in our field and develop meaningful theory that may later be susceptible to quantitative inquiry. I am not suggesting that we eliminate quantitative, positivist inquiry altogether. After all, as Salomon (1991) describes, quantitative (analytic) and qualitative (systemic) inquiry may have complementary functions. However, the qualitative, interpretivist paradigm should proceed the quantitative if we are to identify meaningful hypotheses to investigate empirically.

The difficulty, of course, is assuring that the interpretivist, qualitative inquiry is well-conceived and rigorously applied. There is a danger that researchers in our field will adopt qualitative methodologies to inquiry as poorly as they have quantitative methods. No one becomes an ethnographer or participant observer overnight (Preissle, 1991). Case studies and ethnography can be as poorly conceived and conducted as any other methods (Levine, 1992). It has been observed that some physics graduate students and young physicists gravitate toward research in "cutting edge" topics such as subatomic phenomenon and tabletop fusion not so much because these are the most important topics, but because it is so much easier to get to the frontiers of these areas of physics than it is to develop the background in older areas of inquiry such as solid-state physics. It would be a shame if researchers in our field jumped onto the qualitative bandwagon without adequately preparing themselves for the journey.

What would be the value of expanding observation and reflection in our field? Consider the following quote from the expedition log of John Steinbeck (1941), the noted American author who was also a marine biologist:

> We knew that what we would see and record and construct would be warped, as all knowledge patterns are warped, first by the collective pressure and stream of our time and race, second by the thrust of our individual personalities. But knowing this, we might not fall into too many holes - - we might maintain some balance between our warp and the separate things, the external reality. The oneness of

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[6] The pressure to publish or perish is especially powerful for doctoral students and new faculty members. In light of this, one reviewer of this paper suggested that criticisms aimed at research conducted by doctoral students and new faculty should not be as strong as presented in this paper. However, I think that holding the research of graduate students and new professors to a lower set of standards would be ill-advised. First, it is insulting to their often remarkable capabilities. Second, students and faculty members do not conduct research in a vacuum, unaided by the support and review of their colleagues. This is especially true for doctoral candidates who have the combined research expertise of an entire faculty committee to guide their research efforts. Third, the research conducted by students and new professors constitutes a very large portion of the research carried out in our field and must be rigorously assessed if the field is to advance.

> these two might take its contribution from both. For example: the Mexican sierra has 'XVII-15-IX' spines in the dorsal fin. These can easily be counted. But if the sierra strikes hard on the line so that our hands are burned, if the fish sounds and nearly escapes and finally comes in over the rail, his colors pulsing and his tail beating the air, a whole new relational externality has come into being - - an entity which is more than the sum of the fish plus the fisherman. The only way to count the spines of the sierra unaffected by this second relational reality is to sit in a laboratory, open an evil smelling jar, remove a stiff colorless fish from formalin solution, count the spines, and write the truth 'D. XVII-15-IX." There you have recorded a reality which cannot be assailed - - probably the least important reality concerning either the fish or yourself. It is good to know what you are doing. The man with his pickled fish has set down one truth and has recorded in his experience many lies. The fish is not that color, that texture, that dead, nor does he smell that way. (p. 2)

Do we not now have too much in common with the technician in the lab enumerating the spines of a dead fish when we carry out the type of quantitative studies described above? Further, do we have too little in common with the fisherman struggling with the rocking of the boat, the whipping of the wind, and the thrashing of the fish on the line? Fifty years of quantitative inquiry in instructional technology has provided us with precious little to guide our efforts to enhance education and training. Let us try some other ways.

Author's Notes

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